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The Really obnoxius and Highly Suspect Directive

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The lesser of two evils is still evil.
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Once upon a time, back in 1998, the European Union, in its infinite and collective wisdom, decided there were alarmingly large amounts of hazardous waste being dumped into landfill sites. Someone did some "trend analysis" and concluded that the volume of this hazardous waste would grow at a rate 3 -5 times faster than the average municipal garbage. Responding to this issue, the member states of the EU created the Waste Electrical and Electronics Equipment (WEEE) directive.

The stated purpose of WEEE was to create systems to improve treatment, refuse and recycling of said hazardous materials. It would call for separation of the electronic wastes collected (from other "stuff"). So far, so good. It went on to state that manufacturers would be responsible for certain phases of waste management. Okay, not fun but not everybody's a good "do-bee" when it comes to recycling so this might be an accepted avenue even though it translates to additional ultimate cost to the consumer. Instead of stopping there, it endeavored to "improve" manufacturers' designs to reduce the creation of waste. The concept legislative bureaucrats and environmental fundamentalists regarding "improving" electronic design resulted in the RoHS (Restriction of Hazardous Substances) directive – likely the scariest thing to hit our industry in anyone's memory.

The Really Obnoxious and Highly Suspect (RoHS) directive is usually referred to in the electronics assembly industry as the "Lead-Free" legislation. It indeed does encompass lead-free but it is more – much more. Other "hazardous substances" include mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBE) and polybrominated diphenyl ethers (PBDE). So, besides lead, your products may also have further affliction. Mercury is found in certain contact switches as well as certain types of fluorescent lighting. Cadmium is used on certain contact surfaces as well as batteries of that genre. Hexavalent chromium may be found in the hardware section of your product – screws, nuts, bolts, sheet metal. The PBEs and PDBEs are predominant in flame retardants used in molding compounds and printed circuit board laminate. Oh, if you think the lead in your assembly was restricted to solder, surface finish, lead finish and component internal connections, you can add certain plastics, like PVC and others used in insulation to the list.

Now you can really appreciate why the most difficult part of RoHS compliance is not alloy selection, not reliability testing (though that won't be a picnic, either) – it is logistics. Extracting technical specifications from component manufacturers has always been challenging but that's what is going to have to take place a you review every item on every BoM for every product – at least the ones you want to sell in the EU (Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, Greece, Hungary, Ireland, Italy, Lithuania, Luxemburg, Malta, the Netherlands, Portugal, Poland, Slovak Republic, Slovenia, Spain, Sweden and the UK) after July 1, 2006. To be in compliance with RoHS, the aforementioned materials must be either eliminated or reduced to the within the maximum allowable concentrations. Regarding lead, mercury, hexavalant chromium, PBB and PDBE, this comes to 0.1 % by weight in homogeneous materials. Homogeneous materials are those that cannot be mechanically disjointed into different materials (as in re-cycling). This number did not come from the extremely ambiguous RoHS text but rather from the UK government and has been "accepted" by the industry.

The WEEE directive specifically targets equipment with a voltage rating not exceeding 1500 V-DC and/or 1000 –AC. In its text the enumerated equipment includes:

- Electrical and Electronic Tools
- Toys, leisure and sports equipment
- Medical devices (except implanted devices)
- Monitoring and Control instruments
- Automatic dispensers
- Large and small household appliances
- Consumer telecom electronics
- IT, telecommunications

Of the later, lead in solders used for network infrastructure equipment for switching and signaling appears to be exempt and lead in solders for servers, storage and storage array systems have been granted an exemption until 2010. Hey, nothing like having a good lobbiest, I guess. But here's a baffler: lead in high melting temperature solders such as tin-lead alloys containing more than 85% lead are exempt. Huh? Not sure why that is but too bad the vast majority of our industry missed it by 22% lead. So close yet so far away…

There are other products that are exempt or are petitioning for exemption. However, a lot of manufacturers, including those that might be exempt, are examining the practicality of resisting an ultimate conversion to lead-free.

Many assemblers that are in the "Denial" and "Anger" stages of Lead-free proclaim the unavailability of lead-free components. While there are still quite a few components that are not available with lead-free lead finishes and there will be those that will never be lead-free, many component already are being delivered in compliance with RoHS. The problem is that many of them carry no designation or change in nomenclature to signify that that particular part number is now being delivered as lead-free. There is no notification to the customer by either the component manufacturer or distributor. Some procurement people will periodically check the component manufacturer's website for

"updates" (a very good practice) but in many cases, the first indication that there was a change in the component lead finish is after reflow – or rather non-reflow. The unexpected lead-free lead finish, requiring a higher reflow temperature and not seeing it with the standard lead solder profile, will exhibit inadequate wetting. Further investigation will likely reveal a switcheroo on the part of the component manufacturer. It should be noted that some of the component manufacturers are indeed responsible and have changed the nomenclature by typically adding a suffix to designate lead-free surface finish. But quite a few don't and thus impart a nasty surprise for the unsuspecting assembler. Passives, SOICs, and QFPs are bad enough but it has happened with BGAs and other area arrays which makes for very unpleasant and expensive rework. So rather than fret about not getting components in lead-free finish, start being concerned with component you already are and may not be aware of.
Whether you buy into the ecological benefits or detriments of RoHS, you have to deal with the growing preponderance of lead-free. You can become an isolationist , forfeit your EU markets and thus resist lead-free. This will likely not be too practical and, eventually, a losing proposition. Even companies whose products are currently exempt (ie: avionics, military, under-hood automotive, IT servers) are fervently investigating lead-free. The economics of the situation are the drivers. If most applications (commercial and otherwise) are moving towards lead-free, the demand for lead-free components (and boards) will be in the majority with many leaded configurations fading away due to reduced demand. That isn't to say that lead-bearing components will not be available – they will, but in diminishing variety and eventually higher price. Some will vanish all together. Look at the plight of leaded passives with the advent of SMT.

If you are in the "Bargaining" stage and seeking exemptions, you have to ask how long will those exemptions be in place? Rather than fade away or be indefinitely postponed, as many assemblers are praying for, you can expect to see growing adaptation of lead-free legislation. Already there is such legislation pending in China and Korea, of all places (both so well-known for being major proponents of ecological consciousness). It is likely such legislation will start showing up in the good ol' USA on the state level.

Ultimately, with the current direction, there will be few true exemptions. For the vast majority of the industry, RoHS compliance will be a matter of "get with it or get out of the way". But remember, we're all in this together.

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